Section IV-F – Severe Weather/Santa Ana Winds

Table of Contents

IV-F Severe Weather/Santa Ana Winds

A. California Vulnerability to Windstorms/Severe Weather

The State of California Multi-Hazard Mitigation Plan did not study windstorms, Santa Ana Wind or tornadoes. Santa Ana Wind is the primary concern and this weather condition only impacts Southern California. This study will combine the following issues to make up the Windstorms section:

- Windstorms or High Winds
- Santa Ana Wind Condition
- Tornadoes

B. Orange County Vulnerability to Windstorms/Severe Weather

Severe winds can occur alone, such as during straight-line wind events or it can accompany other natural hazards including hurricanes, and severe thunderstorms. Severe wind poses a threat to lives, property, and vital utilities primarily due to the effects of flying debris or downed trees and power lines. Severe wind will typically cause the greatest damage to structures of light construction, particularly manufactured homes as those used as portable classrooms.

Orange County is subject to high winds, Santa Ana Wind, and tornadoes. An example of a Santa Ana Wind incident that hit Orange County was in January 6, 2003 when the City of Orange was hit with severe Santa Ana Wind as seen on the left. This incident caused downed power and phone lines, closed streets in the City of Orange and required extensive cleanup of the impact area. No lives were lost and there were no serious injuries.

The complex topography of Southern California combined with various atmospheric conditions creates numerous scenarios that may cause widespread or isolated Santa Ana events. Commonly, Santa Ana Winds develop when a region of high pressure builds over the Great Basin (the high plateau east of the Sierra Mountains and west of the Rocky Mountains including most of Nevada and Utah). Clockwise circulation around the center of this high pressure area forces air downslope from the high plateau. The air warms as it descends toward the California coast at the rate of 5 degrees Fahrenheit per 1000 feet due to compressional heating. Thus, compressional heating provides the primary source of warming. The air is dry since it originated in the desert, and it dries out even more as it is heated.

Santa Ana Wind conditions can result in two general disaster conditions. The most common is fire fanned by the high winds. This was the situation in 1993 in Laguna Beach when a massive fire destroyed a number of homes in the hills around Laguna Beach. Santa Ana Wind driven flames caused the destruction of more than 3,000 homes in Southern California in October, 2003. Other forms of disaster would be direct building damage, damage to utilities and infrastructure as a result of the high winds. This has occurred in the past few years in many southland communities including Santa Ana, Orange and Tustin where the RSCCD sites are located.

Santa Ana Winds commonly occur between October and February/March with December having the highest frequency of events. Summer events are rare. Wind speeds are typically north to east at 35 knots through and below passes and canyons with gusts to 50 knots. Stronger Santa Ana Wind can have gusts greater than 60 knots over widespread areas and gusts greater than 100 knots in certain areas. Frequently, the strongest winds in the basin occur during the night and morning hours due to the absence of a sea breeze. The sea breeze which typically blows onshore daily, can moderate the Santa Ana Wind during the late morning and afternoon hours. Santa Ana Wind are an important forecast challenge because of the high fire danger associated with them. Also, unusually high surf conditions on the northeast side of the Channel Islands normally accompany a Santa Ana Wind event. Other hazards include: wind damage to property, turbulence and low-level wind shear for aircraft, and high wind dangers for boaters.

WINDSTORM, SANTA ANA WIND AND TORNADO-LIKE EVENTS

Based on local history, most incidents of high wind in Orange County area are the result of the Santa Ana Wind conditions. While high impact wind incidents are not common to the area, significant Santa Ana Wind events and sporadic tornado activity have been known to negatively impact the local communities. (Actually, the wind miles per hour most often do not meet the legal definition of a tornado by the National Weather Service. However these incidents are always called tornados by the locals.)

WHAT ARE SANTA ANA WINDS?

Santa Ana Wind (sometimes referred to as “Santa Ana’s”) are warm, dry, gusty offshore winds that blow from the east or northeast and occur below the passes and canyons of the coastal ranges of Southern California and in the Los Angeles Basin. According to the National Weather Service, winds must blow at speeds greater than 25 knots to be called Santa Ana Wind. These winds accelerate to speeds of 35 knots as they move through canyons and passes, with gusts to 50 or even 60 knots.

Several meteorological conditions contribute to the phenomenon. The Bernoulli Effect accounts for increased speeds when the desert wind is pushed through narrow canyons. Bernoulli's Law mathematically describes the relationship between pressure and velocity in the horizontal flow of fluids. Although different scenarios may contribute to a Santa Ana Wind, the most common pattern involves a high-pressure region sitting over the Great Basin (the high plateau west of the Rockies and east of the Sierra Mountains).

These regional winds typically occur from October to February/March and according to most accounts, are named either for the Santa Ana River Valley where they originate or for the Santa Ana Canyon, southeast of Los Angeles, where they pick up speed.

In different regional areas, similar wind conditions exist and are named respectively. In the Pacific Northwest, the "Chinooks" are caused by a downhill flow very similar to the Santa Ana Wind. The Northern California version of this wind is sometimes referred to as the "Diablo."

The Beaufort Scale on the following page, was developed by Sir Francis Beaufort in 1805, and it illustrates the effect that varying wind speed can have on sea swells and structures:

The **Beaufort Wind Force Scale** is a measure that relates wind speed at sea or on land although it is a measure of wind speed and not of force in the scientific senses.

TABLE 1 - BEAUFORT WIND FORCE SCALE

BEAUFORT SCALE				
Beaufort Force	**Speed (mph)**	**Wind Description**	**State of Sea**	**Effects on Land**
0	**Less 1**	Calm	Mirror-like	Smoke rises vertically
1	**1-3**	Light Air	Ripples look like scales; No crests of foam	Smoke drift shows direction of wind, but wind vanes do not
2	**4-7**	Light Breeze	Small but pronounced wavelets; Crests do not break	Wind vanes move; Leaves rustle; You can feel wind on the face
3	**8-12**	Gentle Breeze	Large Wavelets; Crests break; Glassy foam; A few whitecaps	Leaves and small twigs move constantly; Small, light flags are extended
4	**13-18**	Moderate Breeze	Longer waves; Whitecaps	Wind lifts dust and loose paper, small branches
5	**19-24**	Fresh Breeze	Moderate, long waves; Many whitecaps; Some spray	Small trees with leaves begin to move
6	**25-31**	Strong Breeze	Some large waves; Crests of white foam; Spray	Large branches move; Telegraph wires whistle; Hard to hold umbrellas
7	**32-38**	Near Gale	White foam from breaking waves blows in streaks with the wind	Whole trees move; Resistance felt walking into wind
8	**39-46**	Gale	Waves high and moderately long; Crests break into spin drift, blowing foam in well marked streaks	Twigs and small branches break off trees; Difficult to walk
9	**47-54**	Strong Gale	High waves with wave crests that tumble; Dense streaks of foam in wind; Poor visibility from spray	Slight structural damage
10	**55-63**	Storm	Very high waves with long, curling crests; Sea surface appears white from blowing foam; Heavy tumbling of sea; Poor visibility	Trees broken or uprooted; Considerable structural damage
11	**64-73**	Violent Storm	Waves high enough to hide small and medium sized ships; Sea covered with patches of white foam; Wave crests blown into froth; Poor visibility	Seldom experienced inland; Considerable structural damage
12	**>74**	Hurricane	Sea white with spray. Foam and spray render visibility almost non-existent	Widespread damage. Very rarely experienced on land

Information taken from the following URL: http://www.compuweather.com/decoder-charts.html

WHAT ARE TORNADOES?

Tornadoes are spawned when there is warm, moist air near the ground, cool air aloft, and winds that speed up and change direction. An obstruction, such as a house, in the path of the wind causes it to change direction. This change increases pressure on parts of the house, and the combination of increased pressures and fluctuating wind speeds creates stresses that frequently cause structural failures.

In order to measure the intensity and wind strength of a tornado, Dr. T. Theodore Fujita developed the Fujita Tornado Damage Scale. This scale compares the estimated wind velocity with the corresponding amount of suspected damage. The scale measures six classifications of tornadoes with increasing magnitude from an "F0" tornado to a "F6+" tornado. The table on the next page depicts the Fujita Tornado Damage Scale:

California does not have large destructive tornados like the mid-west. In fact, the National Weather Service reports that most Orange County events thought to be tornados actually do not meet the minimum wind speed of 73 miles per hour and are just wind storms. Often along the Pacific coast, there are water spouts that come on shore to create tornado-like incidents.

January 19, 2010 Huntington Beach

TABLE 2 - FUJITA TORNADO DAMAGE SCALE

Scale	Wind Estimate (mph)	Typical Damage
F0	< 73	**Light damage.** Some damage to chimneys and TV antennas; breaks twigs off trees; pushes over shallow-rooted trees.
F1	73-112	**Moderate damage.** Peels surface off roofs; windows broken; light trailer houses pushed or overturned; some trees uprooted or snapped; moving automobiles pushed off the road. 74 mph is the beginning of hurricane wind speed.
F2	113-157	**Considerable damage.** Roofs torn off frame houses leaving strong upright walls; weak buildings in rural areas demolished; trailer houses destroyed; large trees snapped or uprooted; railroad boxcars pushed over; light object missiles generated; cars blown off highway.
F3	158-206	**Severe damage.** Roofs and some walls torn off frame houses; some rural buildings completely demolished; trains overturned; steel-framed hangar-warehouse-type structures torn; cars lifted off the ground; most trees in a forest uprooted snapped or leveled.
F4	207-260	**Devastating damage.** Whole frame houses leveled, leaving piles of debris; steel structures badly damaged; trees debarked by small flying debris; cars and trains thrown some distances or rolled considerable distances; large missiles generated.
F5	261-318	**Incredible damage.** Whole frame houses tossed off foundations; steel-reinforced concrete structures badly damaged; automobile-sized missiles generated; trees debarked; incredible phenomena can occur.
F6-F12	319 to sonic	**Inconceivable damage.** Should a tornado with the maximum wind speed in excess of F5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. will create serious secondary damage on structures.

Chart taken from the LA Times Weather Section at the following URL: http://weather.latimes.com/tornadoFAQ.asp

WHAT ARE HURRICANES?

Hurricanes are large, swirling storms. They produce winds of 74 mph or higher. That's faster than a cheetah, the fastest animal on land. Winds from a hurricane can damage buildings and trees. Hurricanes form over warm ocean waters.

The main reason why hurricanes do not hit California is because of cold sea surface temperatures off the California coastline and the California Current.

Hurricanes or tropical cyclones as they are often called, usually need sea surface temperatures above 26.5 °C (80 °F) with a depth of 50 meters (160 feet) to survive. But the waters off the California coast are too cold for tropical cyclones, even during the summer. Normally, the waters' temperatures do not get above 17 °C (70 °F), although El Nino effects may sometimes warm the waters a little bit.

Also the California Current moves down from the northwestern US coast to the southern tip of the Baja California peninsula, which is the opposite in which Northern Hemisphere tropical cyclones move. While a few tropical cyclones may hit the southern and central areas of the Baja California peninsula, they do not make landfall any farther north than that.

Southern California Hurricanes

July 18–20, 2015: The remnants of Hurricane Dolores brought scattered showers and thunderstorms throughout Southern California, breaking many rainfall records and causing flooding. One such flash flood caused a bridge to collapse which shut down Interstate 10 between Indio and Blythe, effectively shutting off the primary Phoenix-to-Los-Angeles route. The good news was that the rain helped firefighters contain the North Fire within 3 days.

September 12–15, 2015: The remnants of Hurricane Linda brought localized downpours from Santa Barbara to San Diego, California.[1] On September 15, Los Angeles received 2.39 inches of rain, making it one of the wettest September days since records dating back to 1877, second only to 1939

COMMUNITY WINDSTORM ISSUES; WHAT IS SUSCEPTIBLE TO WINDSTORMS?

LIFE AND PROPERTY

Based on the history of the region, windstorm events can be expected, perhaps annually, across widespread areas of the region. Obviously, the District and surrounding areas can be adversely impacted during a windstorm event.

Both residential and commercial structures with weak reinforcement are susceptible to damage. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift suction forces that pull building

components and surfaces outward. With extreme wind forces, the roof or entire building can fail, causing considerable damage.

Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelopes, siding, or walls. When Windstorms/Severe Weather strikes a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery.

UTILITIES

Historically, falling trees have been the major cause of power outages in the region. Windstorms such as strong microbursts and Santa Ana Wind conditions can cause flying debris and downed utility lines. For example, tree limbs breaking in winds of only 45 mph can be thrown over 75 feet. As such, overhead power lines can be damaged even in relatively minor windstorm events. Falling trees can bring electric power lines down to the pavement, creating the possibility of lethal electric shock. Rising population growth and new infrastructure in the region creates a higher probability for damage to occur from windstorms as more life and property are exposed to risk.

INFRASTRUCTURE

Severe Weather can damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds.

This photo and the photo on page 2 (taken January 6, 2003 in Orange), demonstrates the damage to infrastructure and utilities from a Santa Ana Wind condition. RSCCD has two sites in Orange.

Severe Winds/Santa Ana Wind can result in damaged buildings or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted.

Industry and commerce can suffer losses from interruptions in electric services and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from Windstorms/Severe Weather related to both physical damages and interrupted services.

INCREASED FIRE THREAT

Perhaps the greatest danger from windstorm activity in Southern California comes from the combination of the Santa Ana Wind with the major fires that occur every few years in the urban/wildland interface zones. With the Santa Ana Wind driving the flames, the speed and reach of the flames is even greater than in times of calm wind conditions. The higher fire hazard raised by a Santa Ana Wind condition requires that even more care and attention be paid to proper brush clearances on property in the wildland/urban interface areas.

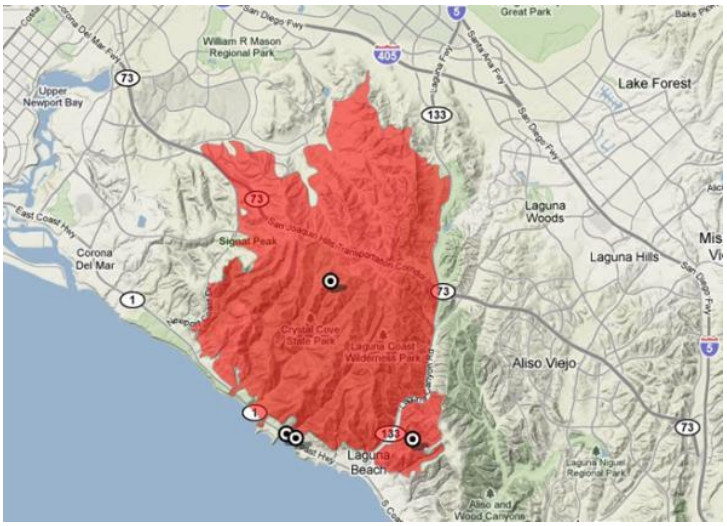
Laguna Beach Firestorm 1993

TRANSPORTATION

Windstorm activity can have an impact on local transportation in addition to the problems caused by downed trees and electrical wires blocking streets and highways. During periods of extremely strong Santa Ana Wind, major highways can be temporarily closed to truck and recreational vehicle traffic and accidents. The Metrolink has been shut down due to extreme high winds stranding commuters.

ORANGE COUNTY HISTORY OF WINDSTORM EVENTS

While the effects of Santa Ana Wind are often overlooked, it should be noted that in 2003, two deaths in Southern California were directly related to the fierce condition. A falling tree struck one woman in San Diego. The second death occurred when a passenger in a vehicle was hit by a flying pickup truck cover launched by the Santa Ana Wind.



The following is a glimpse of some major Santa Ana Wind/windstorm events to hit the local area:

1993 LAGUNA BEACH FIRESTORM

The 1993 Laguna Beach Firestorm was one of the 20 Largest Fires Losses in U.S. History. The area burnt is shown to the left.

This is the worst case scenario, a Santa Ana Wind and fire combined.

A fire burned in Laguna Beach in 1993, consuming 16,000 acres and destroying or severely damaging over 400 homes and causing $528 million dollars in damage. The fire started on October 27, 1993 as a brush fire in Laguna Canyon. It spread when embers jumped a firebreak into Laguna Beach and Emerald Bay. The speed of the fire was phenomenal. The top half of Emerald Canyon burned at a rate of 100 acres per minute. Fire flashed across Laguna Canyon Road in six places, leaping up the slope with 200- feet flames. Fire burned 1.25 miles of brush in 17 minutes to reach Canyon Acres.

After destroying homes in Canyon Acres, the blaze ascended from the canyon floor to obliterate the Mystic Hills neighborhood. By 2 p.m. the fires reaches Emerald Bay and Boat Canyon, jumps Laguna Canyon Road reaching Canyon Acres about 3:30 p.m. The fire raced up the hillside to Skyline /Mystic Hills about 4 p.m. and by 5 p.m. had reached its farthest extremities, to El Morro and Temple Hills. About 10 p.m. the winds shifted and the fire was declared contained by midnight. Mutual aid from other communities included 345 fire engines, 17 dozers, 30 aircraft, 11 hand crews, and a total of 1,968 fire personnel.

The following Santa Ana Wind events were featured in news resources during 2003:

January 6, 2003
OC Register
March 16, 2003"One of the strongest Santa Ana Windstorms in a decade toppled 26 power poles in Orange early today, blew over a mobile derrick in Placentia, crushing two vehicles, and delayed Metrolink rail service." This windstorm also knocked out power to thousands of people in northeastern Orange County.

January 8, 2003
CBSNEWS.com
"Santa Ana's roared into Southern California late Sunday, blowing over trees, trucks and power poles. Thousands of people lost power."

DailyBulletin.com
Fire Officials Brace for Santa Ana Wind
"The forest is now so dry and so many trees have died that fires, during relatively calm conditions, are running as fast and as far as they might during Santa Ana Wind. Now the Santa Ana season is here. Combine the literally tinder dry conditions with humidity in the single digits and 60-80 mph winds, and fire officials shudder."

Vicki Vargas
NBC LA
On February 27, 2010 at 3:20 PM we witnessed a waterspout from Pacific Coast Highway at the Santa Ana River Bridge south to the Newport Beach city limits. It was a tilted cone followed by a stretching and then it hit the water surface.

Earlier a waterspout, flooding and rain hit Huntington Beach. Bulldozers were building a berm on the Huntington Beach waterline. A waterspout came in from the ocean, crossed Pacific Coast Highway; it crossed a track of homes and a parking lot. It lifted a van and tossed it onto its side. Then it went into Huntington Harbour condominium complex and left a path of debris everywhere it went. It battered boats in the harbor and in Peters Landing.

The following is a list of tornado events to hit Orange County:

The following is a list of Major Windstorms and Santa Ana Wind Events in Orange County from 1961 to 2010.

TABLE 3 – ORANGE COUNTY MAJOR WINDSTORM/SANTA ANA WIND EVENTS AND DAMAGE EXTENT

MAJOR WINDSTORM/SANTA ANA WIND EVENTS ORANGE COUNTY AREA 1961- 2010		
DATE	**LOCATION**	**DAMAGE EXTENT**
November 5-6, 1961	Santa Ana Wind	Fire in Topanga Canyon
February 10-11, 1973	Strong storm winds. 57 mph at Riverside, 46 Newport Beach	Some 200 trees uprooted in Pacific Beach alone
October 26-27, 1993	Santa Ana Wind	Fire in Laguna Hills
October 14, 1997	Santa Ana Wind: gusts 87 mph in central Orange County	Large fire in Orange County
December 29, 1997	Gusts 60+ mph at Santa Ana	
March 28-29, 1998	Strong storm winds in Orange County: sustained 30-40 mph. Gust 70 mph at Newport Beach, gust 60 **Huntington Beach**	Trees down, power out, and damage across Orange and San Diego Counties. 1 person died.
September 2, 1998	Strong winds from thunderstorms in Orange County with gusts to 40 mph	Large fires in Orange County
December 6, 1998	Thunderstorm in Los Alamitos and Garden Grove: gust 50-60 mph called "almost a tornado"	
December 21-22, 1999	Santa Ana Wind: gust 68 mph at Campo, 53 **Huntington Beach**, 44 Orange	House and tree damage in Hemet.
March 5-6, 2000	Strong thunderstorm winds at the coast: gust 60 mph at **Huntington Beach**	Property damage and trees downed along the coast
April 1, 2000	Santa Ana Wind: gust 93 mph at Mission Viejo, 67 Anaheim Hills	
December 25-26, 2000	Santa Ana Wind: gust 87 mph at Fremont Canyon	Damage and injuries in Mira Loma, Orange and Riverside Counties
February 13, 2001	Thunderstorm gust to 89 mph in east Orange	
January 6, 2003	Santa Ana Wind storm in the City of Orange	-Toppled 26 power poles in Orange. -Blew over a mobile derrick in Placentia crushing 2 vehicles and delaying the Metrolink service -Knocked out power to thousands in North East Orange County
January 8, 2003	Santa Ana Windstorm	Blew over trees, trucks and power poles
March 16, 2003	Santa Ana Windstorms	80 mph winds and tinder dry conditions
March, 2005	Huntington Beach Water Spout	Huntington Beach closed down the pier and beach area

Information depicted on chart taken from http://www.wrh.noaa.gov/sandiego/research/Guide/weatherhistory.pdf

TABLE 4 - MAJOR TORNADO EVENTS

Major Tornado Events - Orange County Area 1958-2010		
DATE	**LOCATION**	**DAMAGE**
April 1, 1958	Tornado Laguna Beach	
February 19, 1962	Tornado **Irvine**	
April 8, 1965	Tornado **Costa Mesa**	
November 7, 1966	**Newport Beach** and **Costa Mesa**	Property Damage
March 16, 1977	Tornado skipped from Fullerton to Brea	Damage to 80 homes and injured four people
February 9, 1978	Tornado **Irvine**	Property damage and 6 injured
January 31, 1979	Tornado Santa Ana	Numerous power outages
November 9, 1982	Tornadoes in **Garden Grove** and Mission Viejo	Property damage
January 13, 1984	Tornado **Huntington Beach**	Property damage
March 16, 1986	Tornado Anaheim	Property damage
February 22-24, 1987	Tornadoes and waterspouts **Huntington Beach**	
January 18, 1988	Tornadoes Mission Viejo and San Clemente	Property damage
February 28, 1991	Tornado Tustin	
March 27, 1991	Tornado **Huntington Beach**	
December 7, 1992	Tornadoes Anaheim and **Westminster**	Property damage
January 18, 1993	Tornado **Orange County**	Property damage
February 8, 1993	Tornado Brea	Property damage
February 7, 1994	Tornado from **Newport Beach** to Tustin	Roof and window damage. Trees were also knocked down
December 13, 1994	Two waterspouts about 0.5 mile off **Newport Beach**	
December 13, 1995	Funnel cloud near Fullerton Airport	
March 13, 1996	Funnel cloud in **Irvine**	
November 10-11, 1997	Waterspout came ashore at **Newport Pier** on the 10th and dissipated over western **Costa Mesa.** Tornadoes in Irvine on the 11th and a funnel cloud developed.	10th: Winds estimated at 60-70 mph. 11th: Minor power outages occurred with little property damage. A fisherman was blown from one end of Newport Pier to the other. Property and vehicle damage in Irvine from flying debris. Ten cars were thrown a few feet.
December 21, 1997	Waterspout and tornado in **Huntington Beach**	Damage to boats, houses, and city property
February 24, 1998	Tornado in **Huntington Beach**	Property damage with a power outage, roof flew ¼ mile
March 13-14, 1998	Numerous waterspouts between Long Beach, **Huntington Beach**, and Catalina	
March 31-April 1, 1998	Numerous funnel clouds reported off Orange County coastline, two of which became waterspouts off Orange County. One waterspout briefly hit the coast off the **Huntington Beach** pier.	
June 6, 1998	Two funnel clouds off Dana Point	
December 31, 1998	Funnel clouds in Santa Ana. Waterspout off **Costa Mesa**	
February 21, 2000	Tornado Anaheim Hills	Property damage
October 28, 2000	Funnel clouds around **Newport Beach and Costa Mesa**	
January 10, 2001	Funnel cloud at Orange County airport and **Newport Beach**	
February 24, 2001	Tornado in Orange	Damage to warehouse, 6 structures, fences, and telephone wires.
March 2005	**Huntington Beach** Water Spout	Pier and beach closed by Marine Safety Officers
February 27, 2010	**Newport Beach** and **Huntington Beach**	Crossed PCH and went into Huntington Harbour; damaged boats and left a path of debris

Information depicted on chart taken from http://www.wrh.noaa.gov/sandiego/research/Guide/weatherhistory.pdf

C. THE RSCCD VULNERABILITY TO WINDSTORM/SEVERE WEATHER

A windstorm event in Orange County can range from tornado-like winds to Santa Ana Wind conditions. Windstorms in Orange County can cause extensive damage including damage to trees, road and highway infrastructure, and critical utility facilities, leaving the streets covered in debris.

FIGURE 1 - SANTA ANA WIND PATH MAP

The map shows clearly the direction of the Santa Ana Wind as they travel from the stable, high-pressure weather system called the Great Basin through the canyons and towards the low-pressure system off the Pacific. Clearly the coastal areas of Orange County and RSCCD are in the direct path of the ocean-bound Santa Ana Wind.

All facilities in the RSCCD are subject to Santa Ana Wind and the damage caused by these high winds.

A major concern is a fire during a Santa Ana Wind condition. This can result in a small fire spreading quickly to become a catastrophic fire.

RSCCD HISTORY OF WIND EVENTS

Although the RSCCD sites were impacted by many of the Orange County events listed on page 10, fortunately none of the incidents caused deaths, injuries or heavy financial damage to the RSCCD properties. The following is a list of wind related incidents experienced by the RSCCD. None of the incidents were severe. No deaths or injuries resulted from these incidents.

TABLE 5: RSCCD PREVIOUS OCCURRENCES

Date	Location	Type of Damage	Details (from insurance records)	Costs
1/1/2006	Santa Ana College	Weather/wind damage	Metal roof sheeting that covered the pole vault equipment had blown off completely. The roofs had been bolted down to the metal housing unit but due to the high winds, the bolts could not keep the metal sheets in place.	Unknown
10/20/2007	Santa Ana College	Wind damage	Replace the baseball field fence and awning damaged during a wind storm	$81,210
12/2014	Santiago Canyon	Wind damage	Soccer/Softball fencing	$38,080

RSCCD RISK ASSESSMENT OF SANTA ANA WINDS

Windstorms and especially the Santa Ana Winds pose several different types of threats to Orange County including:

Health Issues

- The winds pose a threat to the health of the people with allergies.
- Health risks relate primarily to breathing problems caused by the blowing dust and plant pollen.
- Individuals with serious respiratory problems may require paramedics, ambulances and hospital stays

The winds carry *Coccidioides immitis* and *Coccidioides posadasii* spores into nonendemic areas,a pathogenic fungus that causes Coccidioidomycosis ("Valley Fever"). Symptomatic infection (40 percent of cases) usually presents as an influenza-like illness with fever, cough, headaches, rash, and myalgia (muscle pain). Serious complications include severe pneumonia, lung nodules, and disseminated disease, where the fungus spreads throughout the body. The disseminated form of Coccidioidomycosis can devastate the body, causing skin ulcers, abscesses, bone lesions, severe joint pain, heart inflammation, urinary tract problems, meningitis, and often death.

There is some belief the winds also create positive ions, which are believed to affect mood negatively. Many believe this to be the cause for the statistical increase in the number of suicides

and homicides during these times.

Structural Damage Issues

- Structural issues relating to the winds range from roofs being blown off and building facades being destroyed
- Mobile homes and portable buildings can be blown over or damaged
- Trees may fall onto buildings or block roads and building exits
- Flag poles, light and power poles may be blown over causing injuries and traffic accidents
- Loose furniture and items such as bleachers, patio furniture, trash cans will be blown away and may cause injuries

Electrical Power Issues

- Santa Ana Winds cause power lines to arc, which increases the fire threat
- Santa Ana Winds can either cause trees to fall on power lines or power lines to break, causing power outages
- Power outages are common as the result of Santa Ana Winds

Fire Issues

- The winds increase the threat and/or severity of fires in the urban areas
- Wind-blown flames will spread more rapidly when pushed by high Santa Ana's
- Winds can turn a small fire into a fire conflagration

Debris

Maintenance of trees and shrubbery, removing weak branches and eliminating trees that could fall on structures is a necessity prior to a windstorm. Falling trees and blowing debris in storms often cause fatalities and severe structural damage. Santa Ana Winds create havoc with tree branches, dirt and other items blowing and landing in streets, blocking storm drains, blocking doors, and possibly injuring individuals

EXISTING MITIGATION STRATEGIES

As stated, one of the most common problems associated with windstorms is power outage. High winds commonly occur during winter storms, and can cause trees to bend, sag, or fail (tree limbs or entire trees), coming into contact with nearby distribution power lines. Fallen trees can cause short-circuiting and conductor overloading. Wind-induced damage to the power system causes power outages to customers, incurs cost to make repairs, and in some cases can lead to ignitions that start wildland fires.

One of the strongest and most widespread existing mitigation strategies pertains to debris and tree clearance. Currently, California State Law requires utility companies to maintain specific clearances (depending on the type of voltage running through the line) between electric power lines and all vegetation.

Enforcement of the following California Public Resource Code Sections provides guidance on tree pruning regulations.

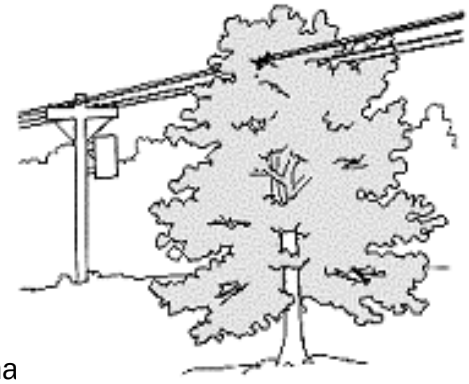
4293: Power Line Clearance Required
4292: Power Line Hazard Reduction
4291: Reduction of Fire Hazards Around Buildings
4171: Public Nuisances

The following pertain to tree pruning regulations and are taken from the California Code of Regulations:

Title 14: Minimum Clearance Provisions
Sections: 1250 – 1258
General Industry Safety Orders

Title 8: Group 3: Articles 12, 13, 36, 37 and 38

California Penal Code: Section 385



The following California Public Utilities commission section ha

California Public Utilities Commission
General Order 95: Rule 35

FIGURE 2: BASIC HUD WIND ZONE MAP FOR MANUFACTURED HOMES

Every school day, more than 5 million students in the United States attend lessons held in modular classrooms. RSCCD has hundreds of portables on their campuses.

All of California is in HUD Wind Zone 1. Each manufactured home must be designed according to the federal Manufactured Home Construction and Safety Standards at 24 CFR 3280, commonly called the HUD Code. The HUD Code stipulates, at §3280.305(c) (1) and §3280.305(c) (2), that the home shall be designed and constructed to conform to one of three wind load zones. The appropriate wind zone used in design is dependent on where the home will be initially installed. Homes designed and constructed to a higher Wind Zone can be installed in a lower Wind Zone (a Wind Zone III home can be installed in a Wind Zone I or II location). However, a Wind Zone I home cannot be installed in either a Wind Zone II or III area.

Wind Zone I, Wind Zone II and Wind Zone III are identified on the basic wind zone map above. The manufactured home producer designs the home to resist the wind load, which is measured in pounds per square foot. Wind Zone I equates to a 70-mph fastest-mile wind speed. Wind Zone II equates to a 100-mph fastest-mile wind speed. Wind Zone III equates to a 110-mph fastest-mile wind speed.

D. CALIFORNIA DSA-STRUCTURAL SAFETY (DSA-SS)

The RSCCD works with the DSA Structural Safety (DSA-SS) who adopts and amends Title 24 Building regulations applicable to California's K-12 public schools, Community Colleges and State Essential Services facilities. Refer to Sections 109.2 of Part 2, Title 24 for more information regarding the scope and application of DSA-SS adopted regulations.

The RSCCD also works closely with DSA on portable classrooms or "factory-built buildings for use as school buildings." All safety measures are determined as site specific requirements as determined by the DSA. The following is from the California Education Code in regards to factory-built buildings used as school buildings:

17351. Except as provided in Section 18930 of the Health and Safety Code, the Department of General Services shall adopt regulations for the safety of design and construction of factory-built buildings for use as school buildings, and shall prescribe procedures for the plans, specifications, methods of construction, and estimates of cost of a factory-built school building to be submitted to the department for approval as provided in Section 17352. Except as provided in Section 18930 of the Health and Safety Code, such regulations shall comply with but not be limited by the provisions of Article 2 (commencing with Section 17260) and Article 3 (commencing with Section 17280) of this chapter.

The Department of General Services shall adopt and submit building standards for approval pursuant to Chapter 4 (commencing with Section 18935) of Part 2.5 of Division 13 of the Health and Safety Code for the purposes described in this section.

17352. A manufacturer of factory-built buildings designed or intended for use as school buildings shall submit to the Department of General Services and the State Department of Education for approval, its plans, specifications, methods of construction, and estimates of cost of such buildings. At the same time the manufacturer shall pay to the Department of General Services a deposit to be applied toward the actual expenses in an amount as determined by the Department of General Services based on the estimated cost of such factory-built buildings, but not exceeding 0.5 percent of such estimated cost. The minimum deposit in any case shall be fifty dollars ($50). The manufacturer shall reimburse the Department of General Services and the State Department of Education for the actual expenses incurred by those departments in the review of such plans and specifications. All fees received by the Department of General Services pursuant to this article are subject to the provisions of Section 17301.

PROBABILITY OF FUTURE OCCURANCE

There was no HAZUS analysis of windstorm available. HAZUS does not have wind data. However, with an analysis of the high wind and tornado events depicted in the "Local History" section, we can deduce the common windstorm impact areas including impacts on life, property, utilities, infrastructure, and transportation. Santa Ana Wind incidents occur several times annually with severe cases 2-3 times per decade.

Using FEMA worksheet 5.1, the Hazard Mitigation Committee ranked the probability of a Santa Ana Wind as **"Highly Likely"** with the with the maximum probable extent or magnitude/strength based on historic events as **"Moderate"** resulting in some damage and loss of services.

E. WINDSTORM MITIGATION STRATEGIES

MITIGATION STRATEGIES

Hazard	**WINDSTORM ACTIVITY #1**
Action Item	**Maintenance & Operations personnel need to review and upgrade their annual Standard Maintenance Plan to include Santa Ana Wind mitigation activities.**
Coordinating Organization	VP of Administrative Services
Ideas for Implementation	Maintain trees and shrubbery, removing weak branches and eliminating trees that could fall on structures during a wind storm. Schedule tree cutting and maintenance for completion prior to/October each year prior to Santa Ana Wind season as part of the Districts scheduled maintenance. 1. Provide education to Maintenance & Operations employees to help them determine the steps needed to get and remain prepared including: 2. Include the comprehensive list in the Emergency Plan a. How employees will be warned of a Santa Ana Wind condition weather warning. b. Keep landscape pruned and remove dead branches regularly c. Cut all trees away from power lines d. Incorporate inspection of the drainage system into the maintenance process. e. Annually inspect all flag and utility poles, signs, antennas, etc. to ensure they are secure and not rotting and do not have the potential to be blown over during a wind incident. f. Secure free standings items such as outdoor furniture, bleachers, etc. g. Research and educate personnel on other methods to mitigate wind damage h. Survey experienced maintenance personnel to find out what issues they have experienced and add their suggestions to the list.
Time Line	Ongoing
Constraints	Time and personnel
Funding Sources	General Fund
Cost Estimate	Staff Time
Benefits: Losses Avoided	By educating Maintenance & Operations employees on mitigation of wind-related emergencies, they can take actions that will help lessen the chance of fatalities, injuries, accidents, debris cleanup time and costs. It will help the campus' remain operational during emergencies if they improve the district's day-to-day maintenance mission. Local, State and FEMA debris cleanup costs will be reduced.
Priority	Medium
Plan Goals Addressed	
	Promote Public Awareness
	Create Partnerships and Implementation
X	Protect Life and Property
	Protect Natural Systems
	Strengthen Emergency Services

Hazard	**WINDSTORM ACTIVITY #2**
Action Item	**Develop a Santa Ana Wind Plan including a list of actions to be taken when a warning is received.**
Coordinating Organization	VP Administrative Services
Ideas for Implementation	1. Maintenance and Operations should develop a comprehensive list of items that should be done when a Santa Ana Wind is predicted. This information is generally known and acted on by the experienced maintenance crews, but it would improve communications and education of newer employees if the list were in written form and emailed to all sites when a wind condition is predicted. 2. Assign a district position this duty and when the high wind prediction is received, the list should be disseminated to all maintenance personnel at each district sites
Time Line	Ongoing
Constraints	Time and personnel
Funding Sources	General Fund
Cost Estimate	Staff Time
Benefits: Losses Avoided	Helps eliminates deaths, injuries, damage, and costs to the district, State and Federal government.
Priority	Medium

Plan Goals Addressed	
	Promote Public Awareness
	Create Partnerships and Implementation
X	Protect Life and Property
	Protect Natural Systems
	Strengthen Emergency Services

Hazard	WINDSTORM ACTIVITY #3 – LONG TERM
Action Item	**Develop an Emergency Power Failure project to supply generators to every RSCCD site for Emergency Operations Centers (EOCs)**
Coordinating Organization	District Director of Maintenance and Operations
Ideas for Implementation	1. Using the Critical Facilities List determine if a generator exists for each site 2. Is the generator sufficient to power the site Emergency Operations Center for 72 hours and provide communications equipment and computers during an emergency? 3. What are the sites generator needs? Cost it out.
Time Line	5 Years
Constraints	Time, personnel and funds
Funding Sources	Hazard Mitigation Program
Cost Estimate	
Benefits: Losses Avoided	Helps eliminate deaths, injuries, damage, and costs to the district, State and Federal government because RSCCD Security and Management personnel will better be able to manage an emergency that impacts its sites and especially a district wide emergency.
Priority	High

Plan Goals Addressed	
	Promote Public Awareness
	Create Partnerships and Implementation
X	Protect Life and Property
	Protect Natural Systems
	Strengthen Emergency Services

TABLE 6: CRITICAL FACILITY GENERATORS NEEDED FOR DISASTER RESPONSE

Facility #	Facility Name	Building/ Room #	Description	Generators (Yes/No) Sufficient (Yes/No)
1	RSCCD District	▪ District EOC: Floor #1 Large Incident: Room 107 District Boardroom Small Incident: Chancellor's Conference Room ▪ IT: Floor #2	Used to manage emergencies for ***all*** RSCCD facilities District Information Technology	
2	Santa Ana College	▪ Campus EOC: -Large Incident: A-214 Caesar Chavez Bldg -Small Incident: X-101/ Campus Safety Office ▪ Student Health Center/ U-120 or #16 IT: A-117/Caesar Chavez Bldg.	Used to manage emergencies at Santa Ana College ▪ Used to Manage medical incidents	
3	Santiago Canyon College	▪ Campus EOC: Building A/01 ▪ Health Care Center: Building T/03 ▪ IT: Building 18, room 107	▪ Used to manage emergencies at Santiago Canyon College ▪ Used to manage medical incidents	
4	Centennial Education Center	▪ Campus EOC: Building A ▪ Large Incident: outside, back of Building E ▪ No Health Care Center	▪ Used to manage emergencies at Centennial Education Center	
5	Orange Education Center	▪ Campus EOC: Parking Lot ▪ No Health Care Center	▪ Used to manage emergencies at Orange Education Center	
7	Orange County Sheriff's Regional Training Academy	▪ Campus EOC: Main Conference Rm ▪ No Health Care Center	Used to manage emergencies at the OC Sheriff's Regional Training Academy	
8	Digital Media Center	▪ Campus EOC: Second Floor Administration	Used to manage emergencies at the Digital Media Center	